

## REMARKS

### **I. Status of Claims**

This Amendment is fully responsive to the Office action dated August 2, 2006. The Examiner is thanked for his thoughtful and thorough review of the application, as indicated by the detailed Office action. The following amendments and remarks are respectfully submitted in response to the Office action.

In the Office action, Claims 1-23 were noted as pending in the application. Claims 1-8, 13 and 16-20 were rejected under 35 U.S.C. 102(b) based on U.S. Patent No. 5,768,124 ("the Stothers patent"). Claims 9-12, 14, 15 and 21-23 were rejected under 35 U.S.C. 103(a) based on the Stothers patent in view of U.S. Patent No. 5,367,612 ("the Bozich patent").

By the present Amendment, Claims 1 and 13 have been amended, Claims 4-9, 14 and 15 have been canceled, and new Claims 24-32 have been added. Reconsideration and withdrawal of the rejection of Claims 1-3, 10-13 and 16-23 is requested for the following reasons. Also, it is submitted that new Claims 24-32 are patentable over the prior art for at least the following reasons.

### **II. Rejection of Claims 1-8, 13 and 16-20 under 35 U.S.C. 102(b) based on the Stothers Patent**

On Page 3, Item 7 of the Office action, Claims 1-8, 13 and 16-20 were rejected under 35 U.S.C. 102(b) based on the Stothers patent. The Stothers patent and the reasons that Claims 1-3, 13 and 16-20 are patentable over the prior art are addressed separately below. Claims 4-8 have been canceled so that the rejection of those Claims is now moot.

#### **A. Legal Standards Regarding Anticipation under 35 U.S.C. 102**

Anticipation under 35 U.S.C. §102 requires that each and every limitation of the claimed invention be disclosed in a single prior art reference. *In re Spada*, 911 F.2d 705, 708 (Fed. Cir. 1990). *See* MPEP 2131; *Verdegaal Bros. v. Union Oil Co.*, 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the . . . claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). Furthermore, the language of 35 U.S.C. 102 stating "A person shall

be entitled to a patent unless...." has been interpreted as putting the burden on the Examiner to establish a *prima facie* case of anticipation. *In re Gene R. Wilder*, 429 F.2d 447, 450 (CCPA 1970). "Only if this burden is met does the burden of coming forward with rebuttal argument or evidence shift to the applicant." *In re Rijckaert*, 9 F.3d 1531, 1532 (Fed. Cir. 1993).

#### **B. U.S. Patent No. 5,768,124 ("the Stothers patent")**

The Stothers patent states as follows:

...FIG. 1 illustrates the operation of an adaptive control algorithm wherein a reference signal  $x(n)$  is received from a source of noise and represents undesired signals. The undesired signals pass through the path A to the region where cancellation is required. The reference signal  $x(n)$  is also passed through an adaptive response filter W which provides an output which is then passed through a gain control G to provide an output signal  $y(n)$ . This signal in practice is modified before it is detected by residual signal detectors to provide the residual or error signal  $e(n)$ . The modification could be the electrical path of the signals or in the case of an acoustic system the acoustic path from the output of a loudspeaker to a microphone. The error signal  $e(n)$  is then fed back to adaptively control coefficients of the adaptive response filter W. The coefficients of the adaptive response filter are adaptive by using the reference signal  $x(n)$  and the error signal  $e(n)$  in an algorithm as described in WO88/02912.

FIG. 1 illustrates only a single channel system where there is only one reference signal, one drive signal and one error signal. However, in practice many reference signals, drive signals and error signals will be used in the system to provide a multichannel system wherein the error signals are reduced by the algorithm to reduce the mean square sum of the error signals. This is preferably

performed by a least mean squares (LMS) algorithm. Thus the W filter acts on the reference signal x(n) to generate the drive signal y(n) which in an acoustic system is sent to a loudspeaker to produce a secondary vibration for canceling undesired acoustic noise within a region. C3, L50 – C4, L11.

The patent further describes the  $\bar{C}$  filter as follows:

...the impulse response C of the system is compensated for by the use of a  $\bar{C}$  filter as in FIG. 2. The  $\bar{C}$  filter provides a model of the response of the error signals e(n) to the drive signal y(n). In an acoustic system this represents the acoustic response within the region of noise cancellation. C5, L58-62.

The signals x(n) are filtered through the  $\bar{C}$  filter to generate a signal r(n) supplied to a least mean square (LMS) algorithm along with the an error signal e(n) to adaptive the coefficients of the adaptive response filter W. FIG. 1; C6, L39-58.

From the foregoing, it is clear that the adaptive control system of the Stothers patent is adapting to the undesired noise signals x(n) by adjusting the coefficients of the adaptive response filter W with the error signal e(n) to produce the drive signal y(n) to cancel the undesired acoustic noise.

### **C. Claims 1-3, 13, and 16-20 are Patentable over the Prior Art of Record**

Claim 1 as amended is restated below for the Examiner's convenience:

1. **(Currently Amended)** A method comprising the step of:
  - a) generating a hedge signal with an adaptive control system to avoid adaptation to at least one characteristic of [[an]] the adaptive control system, the characteristic having an effect to which adaptation would be detrimental to control of a plant with the adaptive control system[[ and/or a plant controlled by the adaptive control system]].

Support for this amendment is found in the Claim as originally filed as well as page 3, lines 1-4 of the subject application, for example. In the Stothers patent, no signal comparable to the hedge signal of Claim 1 is generated. The hedge signal causes the adaptive control system of Claim 1 as amended not to adapt to the characteristic. Certain confusion in the Office action has resulted by the fact that the adaptive control system of the Stothers patent is adapting to the undesired noise signals  $x(n)$  for the purpose of eliminating them with the drive signal  $y(n)$ .

Nonetheless, to further distinguish Claim 1 as amended over the Stothers patent, Claim 1 has been amended to recite that the characteristic has an effect to which adaptation would be detrimental to control of the plant with the adaptive control system. In the Stothers patent, adapting to undesired noise signals  $x(n)$  is not detrimental to control of the plant; in fact, it is the purpose of the Stothers patent's adaptive control system to do so. Thus, Claim 1 as amended is patentable over the prior art of record.

Furthermore, Claim 1 has been amended to state that the characteristic is of the adaptive control system. The Stothers patent does not contemplate eliminating effects of the adaptive control system itself, as opposed to a plant. The Stothers patent simply does not contemplate factors such as control limits, actuator movement limits, command limits, quantization or stepped movements of control surfaces, and so forth, which have effects to which the adaptive control system should not adapt in order to ensure control stability. Claim 1 as amended thus is patentable over the Stothers patent.

Claims 2, 3, 13 and 16-20 depend from Claim 1 and include all of the limitations of that Claim plus additional limitations that are not disclosed in the prior art of record. For example, Claim 2 recites:

2. **(Original)** A method as claimed in claim 1 further comprising the steps of:
  - b) modifying a commanded state signal with the hedge signal; and

c) generating a reference model state signal based on the commanded state signal modified with the hedge signal in the step (b).

No such steps are disclosed in the Stothers patent. The hedge signal is not disclosed in the Stothers patent, and necessarily, step (b) of Claim 2 which uses the hedge signal to modify the commanded state signal, is also not disclosed. Even assuming an erroneous construction in which the  $\bar{C}$  filter is assumed to generate the reference model state signal, the comparison breaks down because the reference model state signal would then be generated before modification of the signal  $x(n)$ , and thus not as claimed in Claim 2.

Claim 3 recites:

3. **(Previously Presented)** A method as claimed in claim 2 further comprising the step of:
  - d) generating a tracking error signal based on the reference model state signal and a plant state signal; and
  - e) generating an adaptive control signal based on the tracking error signal to adapt control response of the adaptive control system.

These steps are not disclosed in the Stothers patents. In the Stothers patent, the drive signal  $y(n)$  is subtracted from the output of the path A to produce the error signal  $e(n)$ . Thus, there is no generation of a tracking error signal through subtraction of the reference model state signal and the plant state signal, as recited in Claim 3.

Independent Claim 13 is recited below for the Examiner's convenience:

13. **(Previously Presented)** In an adaptive control system for controlling a plant, a hedge unit coupled to receive at least one control signal and a plant state signal, the hedge unit generating a hedge signal based on the control signal, the plant state signal, and a hedge model including a first model having a characteristic **of the adaptive control system** to which the adaptive control system

is not to adapt, and a second model not having the characteristic to which the adaptive control system is not to adapt, the hedge signal used in the adaptive control system to remove an effect of the characteristic from a signal supplied to an adaptation law unit of the adaptive control system so that the adaptive control system does not adapt to the characteristic in controlling the plant, **the characteristic having an effect to which adaptation would be detrimental to control of a plant with the adaptive control system.**

Support for this amendment is found in the Claim as originally filed as well as page 3, lines 1-4 of the subject application. Thus, the hedge unit of Claim 13 generates the hedge signal to remove an effect of a characteristic of the adaptive control system itself, as opposed to the plant. This feature clearly is not disclosed in the Stothers patent. Furthermore, Claim 13 recites that the characteristic has an effect to which adaptation would be detrimental to control of a plant with the adaptive control system. Here again, the entire purpose of the Stothers patent is to adapt to the undesired noise signals  $x(n)$  to eliminate them. Thus, Claim 13 is patentable over the prior art of record.

Claims 16-20 depend from independent Claim 13 and include all of the limitations of that Claim plus additional limitations that are not disclosed in the prior art. For example, Claim 16 recites that “the characteristic pertains to a control limit of an actuator used to control the plant,” Claim 17 recites that “the control limit pertains to actuator end points,” Claim 18 recites “the control limit pertains to actuator dynamics,” Claim 19 recites that “the control limit pertains to a rate limit of the actuator,” and Claim 20 recites that “the control limit pertains to quantization effects associated with the actuator.” The cited portions of the Stothers patent merely disclose indication of a fault if impulse response falls outside of a range of what would be considered a normal acoustic response. C3 L14-19; C6 L7-12. However, this does not mean that the Stothers patent is generating a hedge signal to avoid adaptation to a characteristic of the adaptive control system for which adaptation would be detrimental to control of the plant. Therefore, Claims 16-

20 patentably distinguish over the prior art of record for these reasons as well as those stated above for independent Claim 13.

### **III. Rejection of Claims 10-12 and 21-23 under 35 U.S.C. 103(a) based on the Stothers**

#### **Patent in view of the Bozich Patent**

On Page 6, Item 8 of the Office action, Claims 9-12, 14, 15 and 21-23 were rejected under 35 U.S.C. 103(a) based on the combination of the Stothers patent in view of the Bozich patent. The standards for obviousness, the Bozich patent and the reasons that Claims 10-12 and 21-23 are patentable over the prior art, are addressed sequentially below. By the present Amendment, Claim 9, 14 and 15 have been canceled without prejudice so that the rejection of those Claims is now moot.

#### **A. Legal Standards for Obviousness under 35 U.S.C. 103(a)**

The determination of whether an invention is or is not obvious is a legal conclusion based on underlying factual inquiries including: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. *In re Dembiczaik*, 175 F.2d 994, 998 (Fed. Cir. 1999) (*citing Graham v. John Deere, Inc.*, 383 U.S. 1, 17-18, 86 S.Ct. 684, 15 L.Ed.2d 545, 148 U.S.P.Q. 459, 465 (1966)). The Examiner has the burden of establishing a *prima facie* case of obviousness under 35 U.S.C. §103(a). *Ex Parte Martin P. Hageman and Thomas J. Palus*, Appeal No. 2000-1514, Application No. 09/038,450 (*citing In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993)); *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992); *In re Piasecki*, 745 F.2d 1468, 1472, 223 U.S.P.Q. 785, 788 (Fed. Cir. 1984). Only if the Examiner satisfies this initial burden does the burden of coming forward with evidence shift to the Appellant. *Id.* The Examiner can satisfy this burden by showing some objective teaching in the prior art or knowledge generally available to one of ordinary skill in the art suggests the claimed subject matter. *In re Fine*, 87 F.2d 1071, 1074, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

A *prima facie* case of obviousness requires: (1) a suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art,

to modify the reference or to combine the reference teachings; (2) a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest all of the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991); *In re Fine*, 87 F.2d 1071, 1074, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); MPEP § 2142, 8th Ed., Rev. 4. The teaching, suggestion, or motivation to modify or combine features in an effort to obtain the claimed invention must be "clear and particular." *In re Dembicza*k, 175 F.3d 994, 999 (Fed. Cir. 1999).

#### **B. U.S. Patent No. 5,367,612 ("the Bozich patent")**

The Bozich patent discloses an adaptive process control system selectively controlling vibrations in a given medium in real time (Abstract, L1-2). Vibration sensors are used to sense vibration in the medium, and a vibration generator such as an electromagnetic shaker is used to generate offsetting vibrations applied to the medium (Abstract, L8-13). A neural network controller controls the vibration generator so as to force the sensed vibration at a desired point to a given level (Abstract, L13-16). The neural network controller thus adapts to the unwanted vibration in order to eliminate it (Abstract, L16-17).

In Fig. 3B the Bozich patent discloses a neuro-controller 32I that receives signal A0 from a sensor S0 (Fig. 1) that senses external or internal source or forced vibrations of a medium, as well as the difference from node 37 between the signal A0 and the signal A2 output by the dynamic sensor 39 which appears to be used to detect forced and error vibrations of the medium 24 which are to be damped (C6, L50 - C7, L41; C12, L57 – C13, L35). This difference "cse0" is used in the "linearization mode" to linearize the controlled dynamic device 34 (C13, L24-28). The inverse neuro-emulator 36I receives the signal A2 from dynamic sensor 39 and uses it together with the difference between the output of the inverse neuro-emulator 36I and the signal D0 input to the node 35, to adjust the connection weights of the inverse neuro-emulator 36I (C13, L7-11). When the difference generated by node 35 is zero, then the Bozich patent states that the inverse neuro-emulator 36I represents an exact imitation of the inverse transfer function

of the transducer 34 and the media 24 (C13, L11-15). The connection weights of the inverse neuro-emulator 36I are provided to the neuro-controller 32I as indicated by line 33 (C13, L16-20).

The signal "cse0" is the difference between a sensed force vibration and sensed forced and error vibration and nonlinearities of the controlled dynamic device 34 which are sensed from the media 24 (C13, L24-27). The signal "cse0" causes the neuro-controller 32I to adapt to damp error vibration and to linearize the controlled dynamic device 34 (C13, L24-29). Thus, the signal "cse0" causes the neuro-controller 32I to adapt to the error vibration and nonlinearities (C13, L20-24).

### **C. Claims 10-12 and 21-23 Are Patentable Over the Prior Art**

#### **1. The Stothers and Bozich Patents "Teach Away" from the Claimed Invention**

There is no teaching or suggestion that would have led one of ordinary skill in the art to combine the Stothers patent and the Bozich patent as done in the Office action in an attempt to obtain the claimed invention. Nor would a person of ordinary skill in the art have thought there would be any reasonable likelihood of success in obtaining the claimed invention by combining the Stothers patent and the Bozich patent. The Stothers patent and Bozich patent are directed to adapting to undesired acoustic vibration in order to damp it. This is fundamentally different from avoiding adaptation to an effect of a characteristic of the adaptive control system, such as a control or actuator limit, for which adaptation should not occur to stably control a plant with the adaptive control system. Thus, both patents "teach away" from the claimed invention and thus there is no motivation to combine them, nor any reasonable expectation of success for the person of ordinary skill in the art to have done so. Thus, the rejection and combination of the Stothers patent and the Bozich patent are respectfully traversed.

#### **2. Claims 10-12 and 21-23 are Patentable over the Prior Art of Record**

Claims 10-12 depend from Claim 1 and include all of the limitations of that Claim. Because the Bozich patent fails to disclose the deficiencies of the Stothers patent as noted above with respect to the rejection of Claim 1 under 35 U.S.C. 102(b), Claims 10-12 are patentable over the prior art of record. Furthermore, Claim 11 recites that "the plant is an automobile" and

Claim 12 recites that “the plant is an unmanned vehicle.” Although the Bozich patent mentions aircraft, it does not mention automobiles or unmanned vehicles. Thus, Claims 10-12 are patentable over the prior art for these reasons as well as those stated above with respect to Claim 1 as amended.

Claims 21-23 depend from Claim 13 as amended and include all of the limitations of that Claim plus additional limitations that are not disclosed in the prior art of record. For example, Claim 22 recites that “the plant is an automobile” and Claim 23 recites that “the plant is an unmanned vehicle.” These features are not disclosed in either the Stothers patent or the Bozich patent. Accordingly, for these reasons as well as for the reasons stated above with respect to Claim 13, Claims 21-23 are patentable over the prior art of record.

#### **IV. New Claims 24-32 Are Patentable over the Prior Art of Record**

By the present Amendment, new Claims 24-32 have been added to the subject application. Claims 24-30 depend from Claim 1 and include all of the limitations of that Claim. New Claims 24-30 are therefore patentable for the reasons stated above with respect to Claim 1 as amended in response to the rejection under 35 U.S.C. 102(b). Claim 24 recites that “the characteristic is a control limit of an actuator used to control the plant,” and Claims 25-28 recite that the control limit pertains to actuator end points, actuator dynamics, a rate limit of the actuator, and quantization effects associated with the actuator, respectively. The Stothers patent and the Bozich patent fail to disclose hedging out of the effects of actuator characteristics such a control limit as in Claim 24, nor does it disclose the specific kinds of control limits recited in Claims 25-28.

Claims 29-30 depend from Claim 1 and recite that “the characteristic relates to a control limit of the sensor” and Claim 30 recites that “the control limit relates to a speed at which the sensor can sense a state of the plant.” Neither the Stothers patent nor the Bozich patent contemplate hedging out the effect of a characteristic of the adaptive control system, such as the control limits of the sensor, which is detrimental to stable control of a plant.

Claim 31 recites that “the characteristic relates to a control limit of the sensor” and Claim 32 recites that “the control limit relates to a speed at which the sensor can sense a state of the

plant.” Thus, Claims 31 and 32 are patentable for the reasons stated above with respect to Claim 13. In addition, neither the Stothers patent nor the Bozich patent contemplate hedging out the effect of a characteristic of the adaptive control system, such as the control limits of the sensor, which would otherwise be detrimental to stable control of a plant.

Accordingly, for these reasons as well as those stated above with respect to independent Claims 1 and 13, new Claims 24-32 are patentable over the prior art of record.

#### **V. Conclusion**

For the foregoing reasons, Claims 1-3, 10-13, 16-23 as amended and new Claims 24-32 are patentable over the prior art of record. It is therefore respectfully requested that a Notice of Allowance be issued for all pending Claims. The Examiner is encouraged to contact Applicant’s undersigned attorney at (404) 881-4583 to resolve any remaining issues in order to expedite examination of the present application.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,



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Appl. No.: 10/602,458  
Filed: June 23, 2003  
Reply to Office Action of August 2, 2006  
Page 16

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